

REMARKS

(I) Claims 1-3, 5, 7-9, and 12-18 are pending in this application. Claim 1 has been amended to incorporate the recitations of claims 4 and 6. Claims 4, 6 and 19 have been cancelled in this Response. No new claims have been added.

(II) Claim 19 was objected to under 37 CFR 1.75(c), as being improper dependent form for failing to further limit the subject matter of a previous claim. The Examiner indicates that claim 19 fails to further limit claim 1 because it contains the same limitations present in claim 1 for the container. In response, claim 19 has been cancelled from the application.

(III) Claims 1, 2, 4-7, 9-15, 17, and 19 were rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,968,705 to Yamada et al. in view of JP 11-269204.

Applicants traverse the rejection as follows: As recited in claim 1, the claimed invention is directed to a production process of a polymerized toner, comprising Step 1 of forming droplets of a polymerizable monomer composition containing a polymerizable monomer, a colorant and a polymerization initiator in an aqueous dispersion medium containing a dispersion stabilizer to prepare an aqueous liquid dispersion with the droplets dispersed therein, and Step 2 of heating the aqueous liquid dispersion in a polymerization container to polymerize the polymerizable monomer composition, thereby forming colored polymer particles.

In Step 2, a corrosion-resistant metal container, the surface roughness R_y of an inner wall of which is at most 1.0 μm , is used as the polymerization container. The corrosion-resistant metal container is a stainless steel container.

In Step 2, upon the heating of the aqueous liquid dispersion in the polymerization container to conduct polymerization,

- i) the temperature of the aqueous liquid dispersion is raised up to a temperature 5°C lower than a target polymerization temperature at a heating rate of 25 to 50°C/hr,
- ii) the temperature of the aqueous liquid dispersion is raised up to the target polymerization temperature from the temperature 5°C lower than the target polymerization temperature at a heating rate of 10 to 20°C/hr, and
- iii) after the temperature of the aqueous liquid dispersion reaches the target polymerization temperature, a polymerization reaction is carried out while controlling the temperature of the aqueous liquid dispersion so as to fall within a range of (the target polymerization temperature $\pm 3^\circ\text{C}$).

According to the claimed invention, there is provided a production process of a polymerized toner, by which both shortening of polymerization time and reduction in the amount of scale to adhere can be realized at the same time, and scattering of toner properties every production lot or batch is narrow.

In addition, according to the claimed invention, there is provided a production process of a polymerized toner, by which even when polymerization is continuously conducted in the same

polymerization container without cleaning out adhered scale, the above-described shortened polymerization time can be kept without increasing the polymerization time, the amount of scale build-up is little, and a polymerized toner free from deterioration of toner properties can be provided. By the above Step 2, an adhesion of scale to the inner wall of the polymerization container is inhibited.

On the contrary, Yamada discloses a process for producing a polymerized toner comprising the steps of:

raising the temperature of an aqueous dispersion of monomer composition, in which the monomer composition comprises a colorant, a polymerization initiator and a polymerizable monomer component, to a temperature lower than a target polymerization temperature by about 10 to about 40 °C., then

raising the temperature of the aqueous dispersion of monomer composition at the rate of about 1 °C. to about 20 °C. an hour to a temperature lower than the target polymerization temperature by about 5 °C., and then

raising the temperature of the aqueous dispersion of monomer composition at the rate of about 3 °C. to about 10 °C. an hour to the target polymerization temperature,

whereby the polymerizable monomer component is polymerized. See claim 1.

It is important to note that an object of Yamada's invention is to provide a process for producing stably a polymerized toner having excellent balance of shelf stability and fixability,

and high resolution visible image formation (column 1, lines 53-56). In order to achieve such an object, Yamada proposes a method for applying specific thermal hysteresis to an aqueous dispersion containing a polymerizable monomer composition.

The object of Yamada's invention is not to prevent adhesion of scale to an inner wall surface of a polymerization container. Also, the object of Yamada's invention is not to reduce the amount of scale to adhere to the inner wall surface of the polymerization container when the same polymerization container is used to conduct continuous polymerization. When the amount of scale adhered to the inner wall surface of the polymerization container increases, the thermal conductivity of the container wall is lowered, so that it becomes difficult to precisely control the polymerization temperature in addition to lengthened polymerization time. As a result, the quality of the resulting polymerized toner is markedly deteriorated as the number of times of polymerization increases when the same polymerization container is used to conduct continuous polymerization.

Example 1 and Comparative Example 1-2 of Yamada merely show the measured results of the respective properties (Melt Index, Shelf stability and Fixability) of a polymerized toner obtained in each of 5 independent production lots, and average values, standard deviations thereof and etc (Table 1). A variation in toner properties is observed in every production lot. However, a tendency to deteriorate toner properties as the number of production lots increases is not observed. This fact indicates that a polymerization container controlled to the same conditions is used in each production lot. Even in Example 1 and Comparative Example 1-2 of Yamada, heating conditions and reaction conditions are the same in the respective production

lots. Yamada teaches nothing in Example 1 and Comparative Example 1-2 that the same polymerization container was used to conduct continuous polymerization 5 times.

Although Yamada does not specifically describe a material of the polymerization container (reactor), a stainless steel container excellent in corrosion resistance is generally used as the polymerization container in a technical field of the production of polymerized toners by the suspension polymerization process (page 3, lines 11-15 of the present specification).

However, the inner wall surface of the general-purpose stainless steel polymerization container is not highly polished, and the surface roughness R_y thereof is about 4 μm or more. JP 11-269204 shows that the center line average height R_a of a test piece made of a stainless steel (SUS304) subjected to no polishing is 4.56 μm (Tables 1 and 2).

Comparative Example 1 of the present application shows that when a stainless steel polymerization container, the surface roughness R_y of the inner wall of which was 4 μm , was used, the amount of scale produced markedly increased after the 5-batch continuous polymerization, and the polymerization time (heating time + reaction time) lengthened even when the heating rate of the aqueous dispersion at each stage was set to the same as in Example 1, and in addition, the quality of the resultant polymerized toner was markedly deteriorated.

The result of Comparative Example 1 of the present application suggests that even when thermal hysteresis is applied to the aqueous dispersion according to the teaching of Yamada, the same problems as described above are caused unless the surface roughness of the inner wall surface of the polymerization container is made small. Accordingly, the result of comparison of

Example 1 with Comparative Example 1 described in the present application clearly indicates the problems involved in the production process of Yamada.

Yamada neither teaches nor suggests that the surface roughness of the inner wall surface of the stainless steel polymerization container is made small, and the conditions for the thermal hysteresis to the aqueous dispersion are changed for the purpose of shortening the polymerization time and reducing the amount of scale to adhere.

JP 11-269204 discloses that “Claim 1: A method of preventing adhesion to a polymerization vessel used in emulsion polymerization of a copolymer latex, wherein the surface roughness of an inner wall in the polymerization vessel is $(Ra) \geq 0.3 \mu\text{m}$ in terms of center line average height, and the inner wall surface is coated with a silane-containing polymer.”

JP 11-269204 describes that “In the present invention, the durability of a silane-containing polymer coating film coated becomes poor, and its adhesion-preventing effect is also lowered unless the center line average height (Ra) of the inner surface of a polymerization vessel is $0.3 \mu\text{m}$ or more.” (Paragraph [0008])

An important feature of the method disclosed in JP 11-269204 resides in that the adhesion of a polymer to the inner surface of the polymerization vessel is prevented by the silane-containing polymer coating film.

In this respect, the Examiner’s attention is now directed to the resulting data which are disclosed in Table 1 of JP 11-269204. Examples of JP 11-269204 show that even when an inner wall of a polymerization vessel is buff-polished so as to give a small surface roughness Ra of

0.30 μm or 0.39 μm , deposits adhere to the whole surface thereof unless the inner wall is coated with a silane-containing polymer. Table 1 of JP 11-269204 shows that unless an inner wall of a polymerization vessel, the surface roughness Ra of which is within a range of 0.30 to 4.56 μm , is coated with a silane-containing polymer, deposits adhere to the whole surface of the inner wall. See the evaluation of adhered condition as “x” in Table 1 of JP 11-269204. On the other hand, Examples of JP 11-269204 show that even when the surface roughness Ra of an inner wall of a polymerization vessel is within a range of 1.54 to 4.56 μm , adhesion of deposits can be effectively prevented by coating the inner wall with the silane-containing polymer. See the evaluation of adhered condition as “o” or “◎” in Table 1 of JP 11-269204. In addition, Table 1 of JP 11-269204 shows that when the inner wall of the polymerization vessel is polished until the surface roughness Ra reaches 0.24 μm , it is difficult to remove a polymer adhered even when the inner wall is coated with the silane-containing polymer. See the evaluation of adhered condition as “△”.

That is, JP 11-269204 clearly teaches that the adhesion of a polymer cannot be effectively prevented only by making the surface roughness of the inner wall of the polymerization vessel small.

In Yamada’s invention, the object thereof is not to inhibit adhesion of scale to the inner wall surface of the polymerization vessel. On the other hand, JP 11-269204 clearly teaches that the adhesion of a polymer cannot be prevented only by making the surface roughness of the inner wall of the polymerization vessel small. Therefore, even if the teachings of these two cited

references are combined for the purpose of inhibiting the adhesion of scale to an inner wall surface of a polymerization container in a production process of a polymerized toner by suspension polymerization, the formation of a silane-containing polymer coating film on the inner wall surface of the polymerization container might have been derived. However, even one of ordinary skill in the art does not become motivated to polish the inner wall of the polymerization container until the surface roughness R_y of the inner wall thereof reaches 1.0 μm or less by the combination of these two cited references.

JP 11-269204 is directed to a polymerization vessel used in emulsion polymerization of the copolymer latex, and is not directed to a polymerization vessel used in suspension polymerization. The latex is an emulsion that a polymer is colloidally dispersed in water by the action of an emulsifier. The latex that a polymer is dispersed as fine particles (colloid) of 1 μm or less in water by the action of an emulsifier is presumed to be different from polymer particles formed by suspension polymerization in the form and degree of adhesion of a polymer to an inner wall of a polymerization container.

In contrast, in the production process of the present invention, a corrosion-resistant metal container, the surface roughness R_y of an inner wall of which is at most 1 μm , is used as a polymerization container in a production process of a polymerized toner by a suspension polymerization process, whereby the amount of scale adhered to the inner wall can be markedly reduced, and the lowering of the thermal conductivity of the inner wall can be prevented by reducing the amount of scale adhered. In addition, the temperature of an aqueous liquid

dispersion can be stably controlled even when the heating rate of the aqueous liquid dispersion is accelerated, so that the polymerization time can also be shortened. The polymerization container used in the claimed invention does not need coating the inner wall thereof with the silane-containing polymer. The silane-containing polymer may possibly adversely affect properties of the resulting polymerized toner.

Accordingly, even one of ordinary skill in the art is not motivated to use the corrosion-resistant metal container, the surface roughness R_y of the inner wall of which is at most 1 μm , is used as a polymerization container in the production process of a toner of Yamada on the basis of the teaching of JP 11-269204.

In the Office Action, the Examiner stated that “With respect to the Yamada’s heating to a temperature lower than the target polymerization temperature by about 5°C, the suggestion of heating rate of about 20°C/hr would include values larger than 20°C/hr because Yamada specifically chose to add the relative qualifier “about” to the heating range. A value of 25°C/hr would be considered to be about 20°C/hr to the skilled artisan (Page 3, lines 10-14).” However, even the skilled artisan does not understand that “about 20°C/hr” also includes the value of 25°C/hr. Yamada recites that the temperature is raised up to a temperature lower than the target polymerization temperature by “about 5°C” from a temperature lower than the target polymerization temperature by about 10 to about 40°C at a rate of from about 1°C/hr to about

20°C/hr. The temperature is raised up to the target polymerization temperature from the temperature lower than the target polymerization temperature by about 5°C at a rate of from about 3°C/hr to about 10°C/hr (claim 1).

If the teaching of “about 20°C/hr” can be interpreted as including the value of 25°C/hr that is higher by no less than 5°C than 20°C as asserted by the Examiner, the lower limit value of “about 1°C/hr” must include a value of –4°C/hr that is lower by no less than 5°C/hr than 1°C/hr. In addition, the temperature which is lower than the target polymerization temperature by “about 5°C” comes to include the target polymerization temperature higher by 5°C than that temperature. According to such interpretation, the process of Yamada is full of inconsistencies. There is no basis to include the value of 25°C/hr in the upper limit taught by the reference. The Examiner’s assertion is baseless. Accordingly, a skilled artisan does not understand that “about 20°C/hr” also includes the value of 25°C/hr.

In the Office Action, the Examiner stated that “Heating 5°C at a rate of about 20°C/hr would take about 15 minutes. The instant claims require heating at 25°C/hr and include within their scope the same heating difference as specified by Yamada. Heating polymerizable liquid by 5°C at a rate of about 25°C/hr would take 12 minutes (Page 3, lines 18-21).” The Examiner concluded that the artisan of ordinary skill in this art would see heating times of 12 minutes and about 15 minutes to be differences in design choice and, lacking objective evidence of an unexpected result, within the normal design modifications undertaken by the artisan.

However, when the temperature is raised by 5°C at a rate of 1°C/hr that is a lower limit value in Yamada, it takes 5 hours. On the other hand, when the temperature is raised by 5°C up to the target polymerization temperature at a rate of 50°C/hr that is an upper limit value in the present invention, it takes only 0.1 hours (6 minutes). In short, according to the process of Yamada, it takes a time within a range of from 15 minutes to 5 hours to raise the temperature up to the target polymerization temperature from the temperature lower than the target polymerization temperature by 5°C, while according to the process of the claimed invention, it takes only a short time of from 6 minutes to 12 minutes.

According to the process taught by Yamada, the temperature is raised up to the target polymerization temperature from the temperature lower than the target polymerization temperature by 5°C at a rate of preferably from about 3°C/hr to about 10°C/hr (column 25, lines 4-10). When the temperature is raised by 5°C at a rate of about 10°C/hr that is a preferable upper limit value in Yamada, it takes 30 minutes. On the other hand, when the temperature is raised by 5°C at a rate of about 3°C/hr that is a preferable lower limit value in Yamada, it takes 100 minutes.

The Examiner should note that it is an extremely difficult subject to shorten the polymerization time (heating time + reaction time) while retaining the stability of a polymerization reaction. Accordingly, it is wrong to underrate the difference in the heating time between the process of the present invention and the process of Yamada from the viewpoints of improvement in productivity and improvement in the quality of a polymerized toner.

Here, Applicants emphasize the test data summarized in Table 1 of the present specification. As apparent from the results shown in Table 1, according to the production process (Example 1) of the claimed invention, the polymerization time is short, and the amount of scale produced is small even after the 5-batch continuous polymerization. In addition, a high-quality polymerized toner stable in fixing ability, storability, printing density and MI value can be obtained.

On the other hand, when the polymerization container, the surface roughness R_y of the inner wall of which is great, is used (Comparative Example 1), the polymerization time lengthens, and the amount of scale produced becomes great after the 5-batch continuous polymerization. In addition, scattering of fixing ability, storability, printing density, MI value, etc. becomes wide, and the quality of the polymerized toner is deteriorated.

As described above, the result of Comparative Example 1 suggests that even when thermal hysteresis is applied to the aqueous dispersion according to the teaching of Yamada, the same problems as described above are caused.

In addition, the Applicants herewith submit the Declaration under 37 CFR 1.132 by the co-inventor Junichi TAKASHIMA to further demonstrate the deficiencies in the teachings of Yamada with respect to the presently claimed processes.

As described in the Declaration, Mr. Takashima performed Experiment 1 by the same manner as in Example 1 described in the present specification except for using the heating rate specifically taught by Yamada. In Experiment 1, a stainless steel polymerization container which

has an inner wall having the surface roughness R_y of 0.3 μm was used, and heating conditions (thermal hysteresis) shown as the best mode in Example 1 of Yamada were adopted. Experiment 1 of the Declaration clearly shows that even when the stainless steel polymerization container, the surface roughness R_y of the inner wall of which is 0.3 μm , was used, the heating time somewhat lengthened when heating conditions of an aqueous dispersion were set to the heating conditions shown as the best mode in Example 1 of Yamada, and consequently the polymerization time (heating time + reaction time) also lengthened, the amount of scale adhered tended to increase when the same polymerization container was used to conduct 5-batch continuous polymerization, and the quality of the resultant polymerized toner was also adversely affected (Table 1). The results of Example 1 and Comparative Example 1 of the present specification are also shown collectively in Table 1 of the Declaration.

As described above, even when the surface roughness of the inner wall of the polymerization container is made small, the amount of scale adhered tends to increase after the continuous polymerization when the heating time somewhat lengthens. Accordingly, both shortening of the polymerization time and reduction of the amount of scale adhered can be realized by making the surface roughness of the inner wall of the polymerization container small and selecting the heating conditions of the aqueous dispersion according to the teachings of the claimed invention.

Therefore, the process recited in claim 1 of the present application cannot be derived by combining the teachings of the two cited references. The excellent advantageous of the present invention cannot possibly be anticipated from the two cited references.

It is therefore submitted that the presently claimed invention recited by claims 1-3, 5, 7-9, and 12-18 are nonobvious over and patentably distinguishable from the cited combination of references, and that the rejection under 35 U.S.C. 103(a) has been overcome. Reconsideration is respectfully requested.

(IV) Claim 3 was rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,968,705 to Yamada et al. in view of JP 11-269204, and further in view of JP 2003-287928.

The Applicants traverse the rejection as follows: As discussed above, the presently claimed invention recited by claims 1-3, 5, 7-9, and 12-18 are nonobvious over and patentably distinguishable from the cited combination of Yamada et al and JP 11-269204.

JP 2003-287928 merely discloses that in a production process of a polymerized toner, which comprises the steps of dispersing a polymerizable monomer composition containing at least a polymerizable monomer and a colorant as droplets in an aqueous dispersion medium containing a dispersion stabilizer and then polymerizing the composition with a polymerization initiator to form colored polymer particles, which comprises a series of steps composed of

(1) Step 1 of forming droplets of the polymerizable monomer composition containing at least the polymerizable monomer and the colorant in a first aqueous dispersion medium (A) containing the dispersion stabilizer to prepare a first aqueous liquid dispersion (B), in which the droplets are dispersed,

(2) Step 2 of mixing the first aqueous liquid dispersion (B) with a second aqueous dispersion medium (C) containing 0.1 to 5% by weight of the dispersion stabilizer to prepare a second aqueous liquid dispersion (D) containing the second aqueous dispersion medium (C) in a proportion of 10 to 150 parts by weight per 100 parts by weight of the polymerizable monomer in the first aqueous liquid dispersion (B), and

(3) Step 3 of polymerizing the polymerizable monomer composition dispersed as the droplets in the second aqueous liquid dispersion (D) with the polymerization initiator in a polymerization kettle to form the colored polymer particles.

This process of JP 2003-287928 is only effective for preventing the adhesion of scale, but is not effective for accelerating the heating rate. When water or the aqueous dispersion medium is sprayed within the reaction container during polymerization, it is effective for preventing the adhesion of scale. However, the effect is limited to a range above the level of the aqueous liquid dispersion in the polymerization container. This process is not effective for accelerating the heating rate. On the other hand, Yamada does not suggest heating rates to the skilled artisan that overlap with those claimed. JP 2003-287928 can not remedy the deficiencies of Yamada and JP

It is therefore submitted that the presently claimed invention recited by claim 3 is not obvious over the cited references.

(V) Claim 8 was rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,968,705 to Yamada et al. in view of JP 11-269204, and further in view of JP 2003-277405.

The Applicants traverse the rejection as follows: As discussed above, the presently claimed invention recited by claims 1-3, 5, 7-9, and 12-18 are nonobvious over the combination of Yamada and JP 11-269204.

JP 2003-277405 discloses “A method of preventing a polymer from adhering to a polymerization vessel used in emulsion polymerization, which comprises buff-polishing or electropolishing an inner wall of the polymerization vessel to control R_{max} in the inner wall to 0.5 to 1.2 μm .” See claim 1 of JP 2003-277405.

However, JP 2003-277405 is directed to a polymerization vessel used in emulsion polymerization of a copolymer latex, and is not directed to a polymerization vessel used in suspension polymerization. JP 2003-277405 does not disclose that the polymerization vessel thereof is used in suspension polymerization, and does not suggest that the vessel is used in a polymerization process of a polymerized toner by a suspension polymerization process.

In addition, Example 1 of JP 2003-277405 shows that even when a polymerization vessel polished by buff-polishing and electropolishing until R_{max} of an inner wall reached 0.8 μm was used, 0.1% by mass, based on the whole polymer obtained by emulsion polymerization, of a polymer adhered to the inner wall of the polymerization vessel. Comparative Example 1 of JP 2003-277405 shows that even when a polymerization vessel polished by buff-polishing alone until R_{max} of an inner wall reached 1.0 μm was used, 0.3% by mass, based on the whole polymer obtained by emulsion polymerization, of a polymer adhered to the inner wall of the polymerization vessel. A difference in the amount of the polymer adhered between Example 1 and Comparative Example 1 of JP 2003-277405 is merely a relative difference.

As described above, JP 2003-277405 shows that even when the inner wall of the polymerization vessel is polished to make the surface roughness thereof small, the polymer formed by the emulsion polymerization adheres to the inner wall in a considerable proportion. Therefore, it is apparent that one of ordinary skill in the art presumes that increase in the amount of scale adhered after continuous polymerization cannot be effectively prevented even when a polymerization vessel, the inner wall of which has been polished by buff-polishing and electropolishing until the surface roughness R_{max} thereof reached 0.5 to 1.2 μm , was used according to the teaching of JP 2003-277405.

In contrast, according to the production process of the claimed invention, the amount of scale adhered to an inner wall of a polymerization container is markedly reduced, and the polymerization time can be greatly shortened even when the heating rate of an aqueous liquid dispersion containing a polymerizable monomer composition is accelerated.

In addition, according to the production process of the present invention, a polymerized toner narrow in scattering of toner properties every production lot can be stably produced even when the heating rate of an aqueous liquid dispersion containing droplets of the polymerizable monomer composition is accelerated.

JP 2003-277405 neither discloses nor suggests the above-described features of the present invention.

Therefore, the presently claimed invention recited by claim 8 is not obvious over the cited references. Reconsideration is respectfully requested.

(VI) Claims 16 and 18 were rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,968,705 to Yamada et al. in view of JP 11-269204, and further in view of US Patent No. 5,958,640 to Hasegawa et al.

The Applicants traverse the rejection as follows: As discussed above, the presently claimed invention recited by claims 1-3, 5, 7-9, and 12-18 are nonobvious over the combination of Yamada and JP 11-269204.

Hasegawa et al. merely disclose a polymerized toner of core-shell structure and the production process thereof. Hasegawa et al. neither teach nor suggest a production process of a polymerized toner as presently claimed. Hasegawa et al. can not remedy the deficiencies of Yamada and JP 11-269204.

It is therefore submitted that the presently claimed invention recited by claims 16 and 18 are not obvious over the cited references. Reconsideration is respectfully requested.

(VII) In view of above, Applicants submit that the claims, as herein amended, should not be rejected under 35 U.S.C. 103(a), and are in condition for allowance. Applicants request such action at an early date. If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned representative at the telephone number indicated below to arrange for an interview to expedite the disposition of this case. If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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Attachments: Declaration under 37 C.F.R. §1.132
Petition for Extension of Time